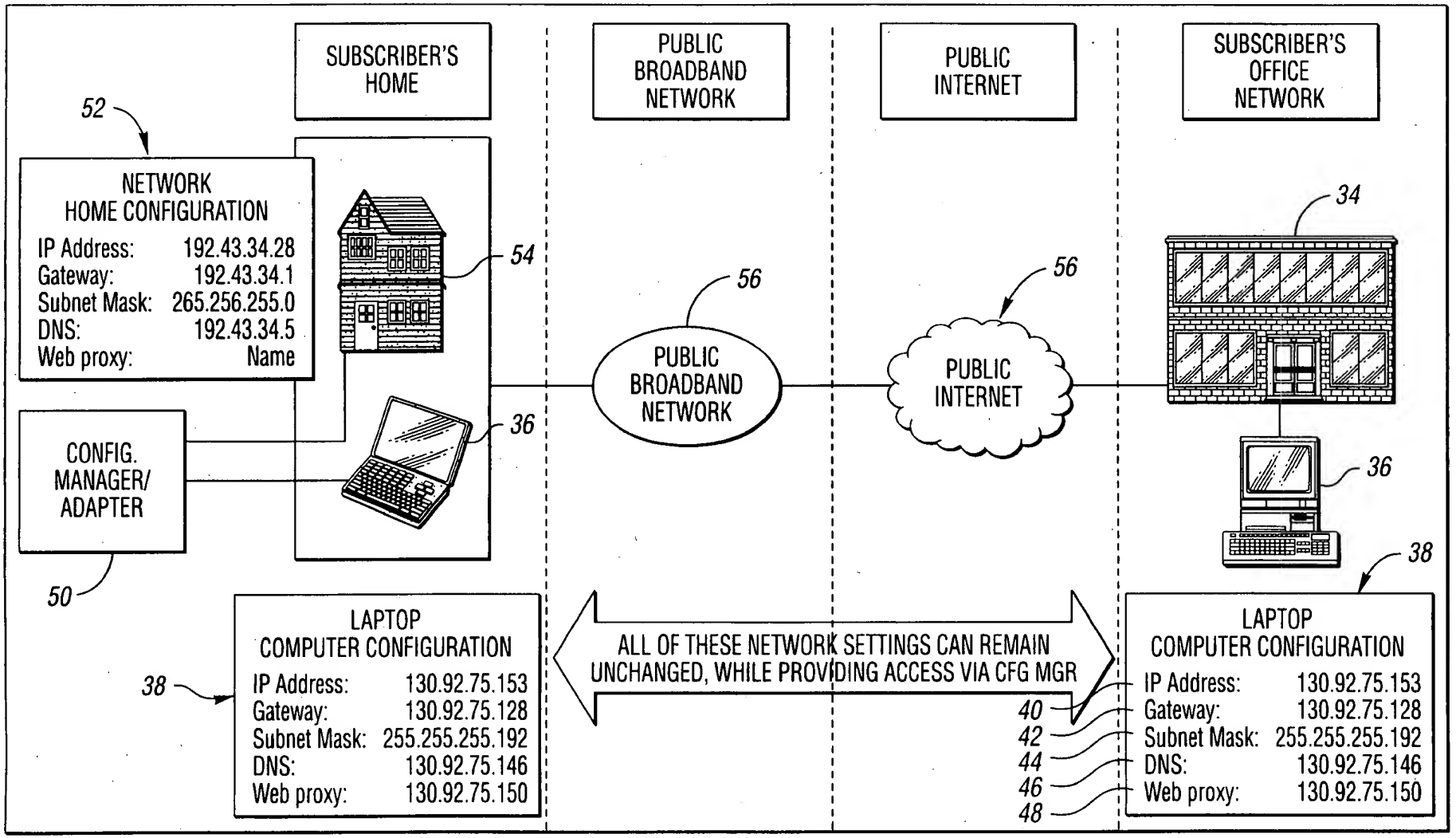

SUBSCRIBER'S HOME
PUBLIC BROADBAND NETWORK
PUBLIC INTERNET
SUBSCRIBER'S OFFICE NETWORK
52
NETWORK HOME CONFIGURATION
IP Address: 192.43.34.28
Gateway: 192.43.34.1
Subnet Mask: 265.256.255.0
DNS: 192.43.34.5
Web proxy: Name
54
56
56
34
PUBLIC BROADBAND NETWORK
PUBLIC INTERNET
36
36
CONFIG. MANAGER/ ADAPTER
50
38
LAPTOP COMPUTER CONFIGURATION
IP Address: 130.92.75.153
Gateway: 130.92.75.128
Subnet Mask: 255.255.255.192
DNS: 130.92.75.146
Web proxy: 130.92.75.150
38
ALL OF THESE NETWORK SETTINGS CAN REMAIN UNCHANGED, WHILE PROVIDING ACCESS VIA CFG MGR
40
42
44
46
48
LAPTOP COMPUTER CONFIGURATION
IP Address: 130.92.75.153
Gateway: 130.92.75.128
Subnet Mask: 255.255.255.192
DNS: 130.92.75.146
Web proxy: 130.92.75.150
30

Fig. 1

SUBSTITUTE SHEET (RULE 26)

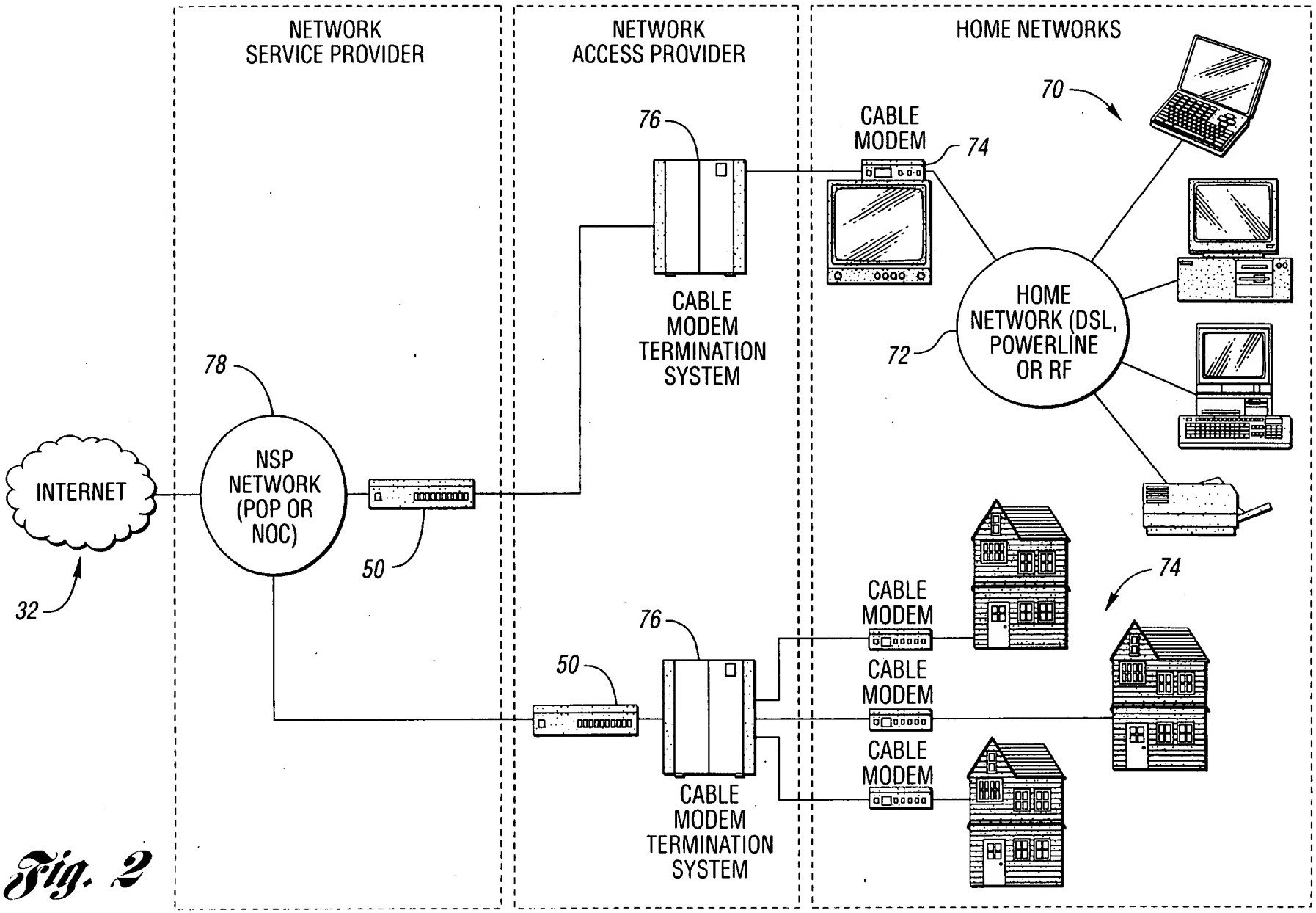


Fig. 2

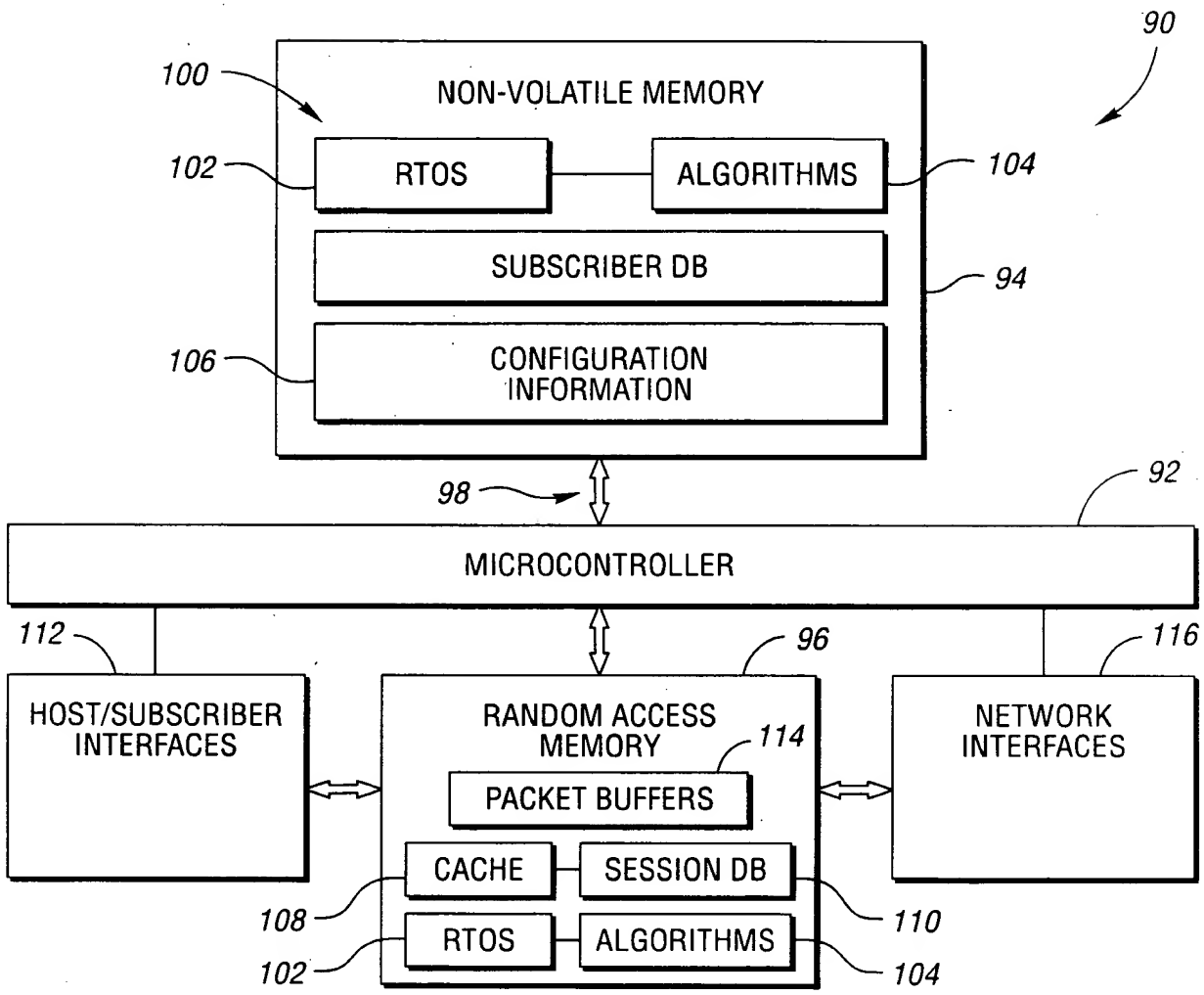

90
100
NON-VOLATILE MEMORY
102
RTOS
ALGORITHMS
104
SUBSCRIBER DB
94
106
CONFIGURATION INFORMATION
98
92
MICROCONTROLLER
112
96
116
HOST/SUBSCRIBER INTERFACES
RANDOM ACCESS MEMORY
114
PACKET BUFFERS
NETWORK INTERFACES
CACHE
SESSION DB
108
110
RTOS
ALGORITHMS
102
104

Fig. 3

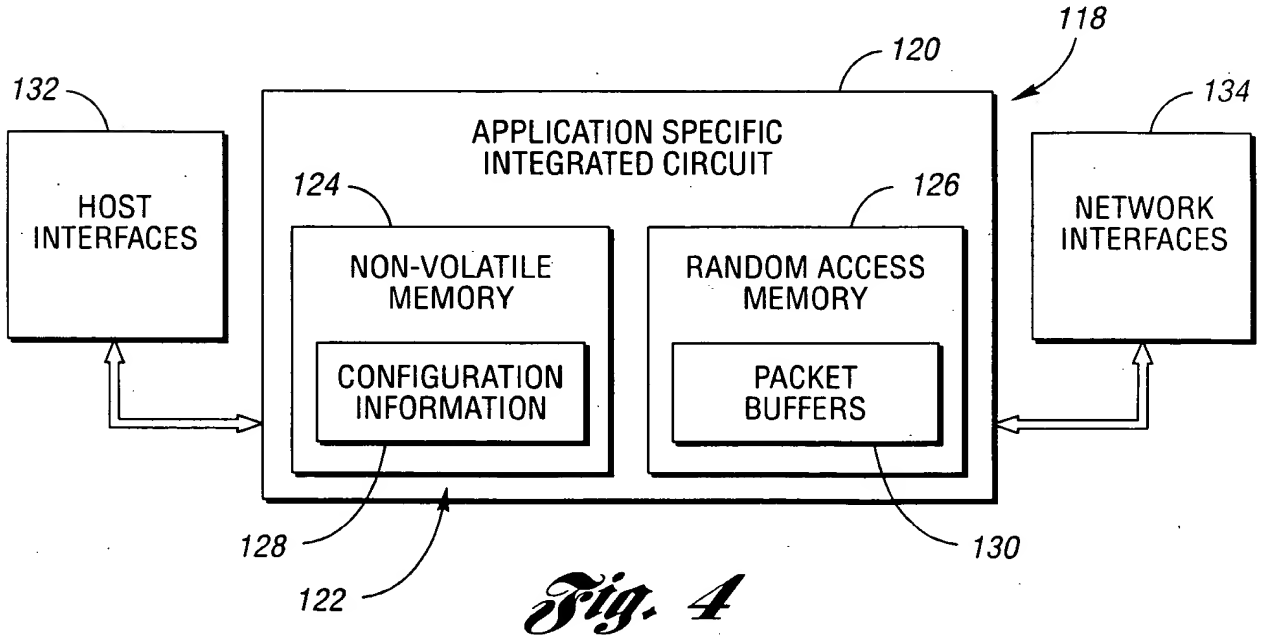

118
120
132
134
APPLICATION SPECIFIC INTEGRATED CIRCUIT
HOST INTERFACES
124
126
NON-VOLATILE MEMORY
RANDOM ACCESS MEMORY
NETWORK INTERFACES
CONFIGURATION INFORMATION
PACKET BUFFERS
128
130
122

Fig. 4

DOCKET ALARM

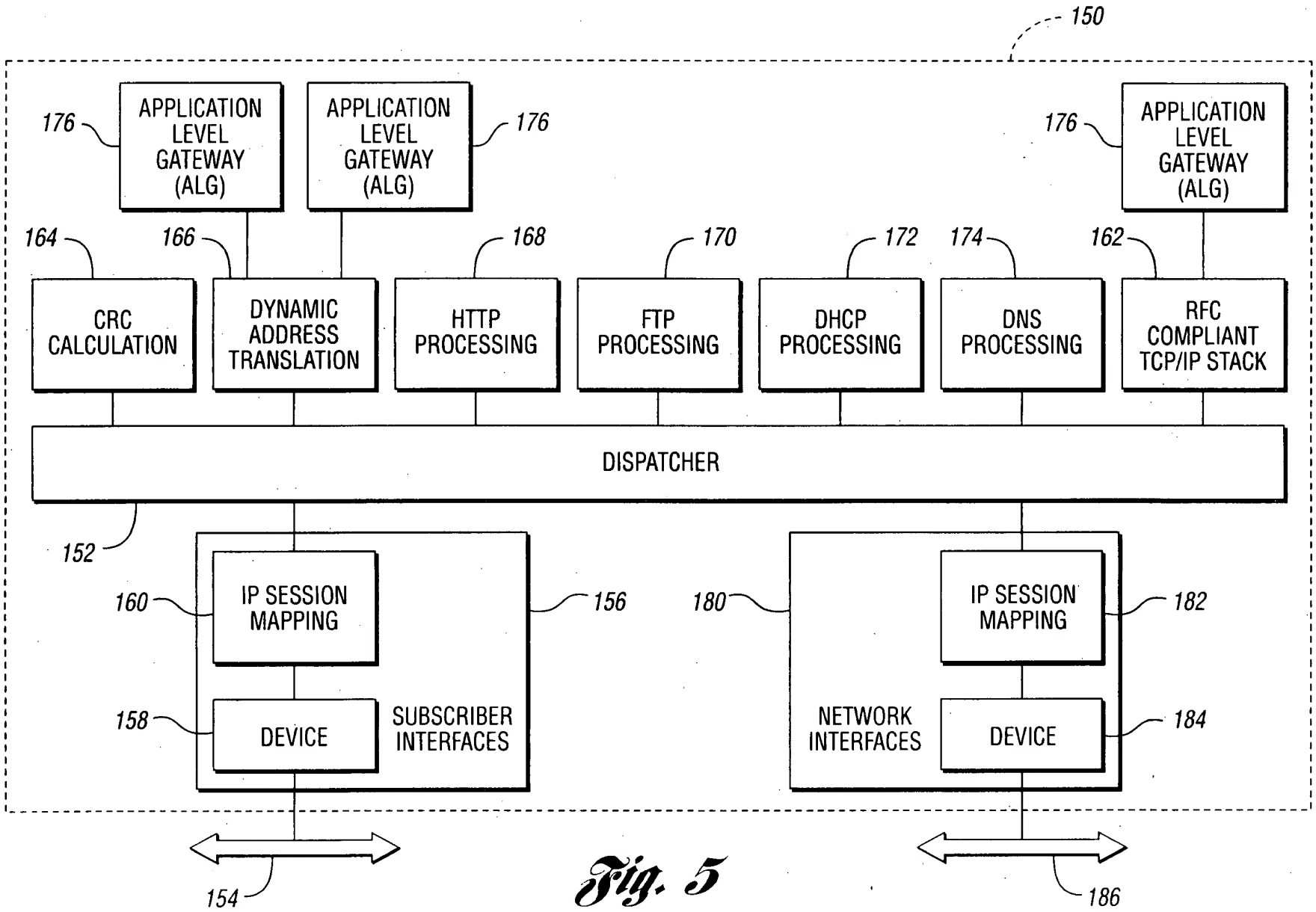


Fig. 5

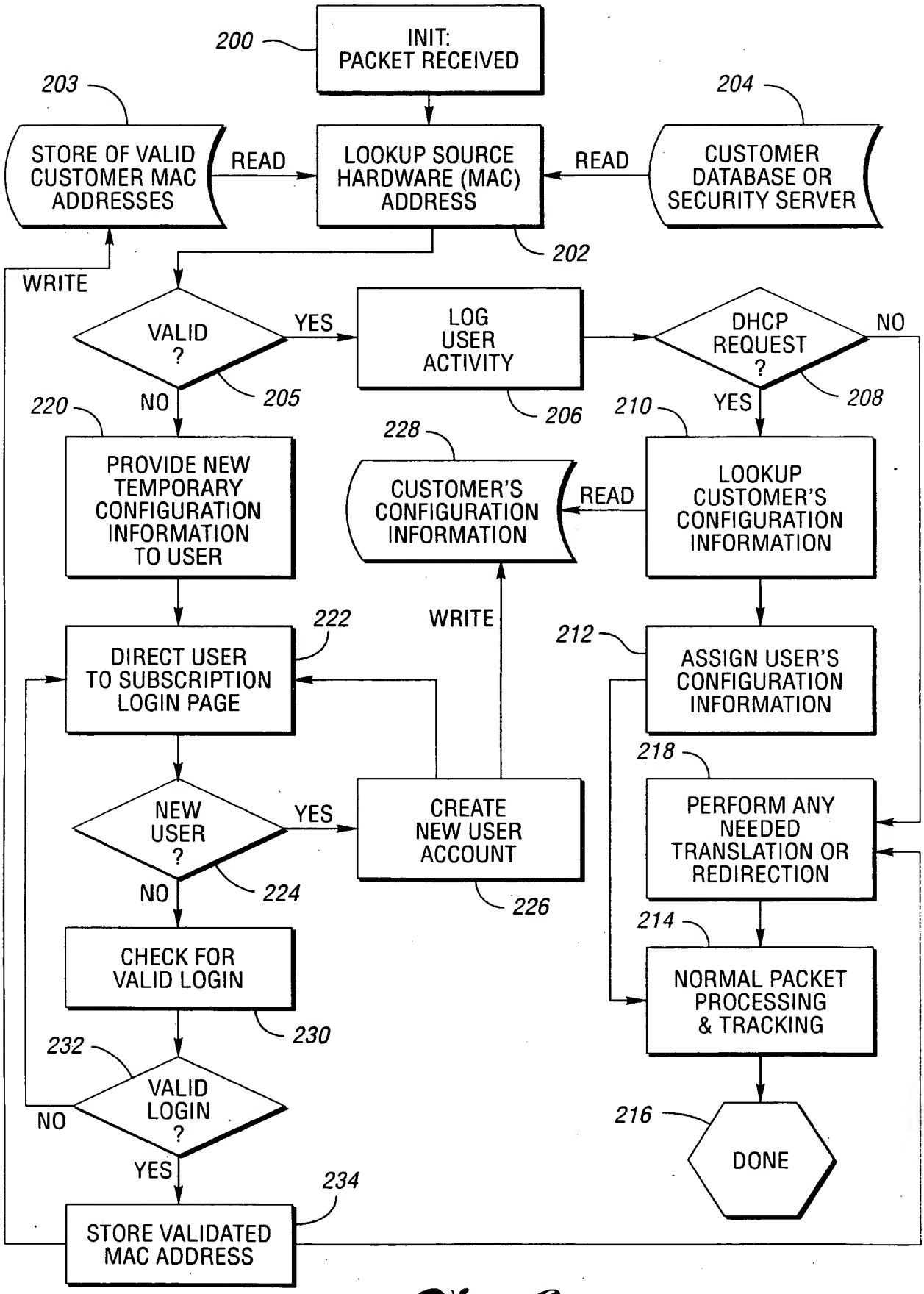

200
INIT:
PACKET RECEIVED
203
STORE OF VALID CUSTOMER MAC ADDRESSES
READ
LOOKUP SOURCE HARDWARE (MAC) ADDRESS
READ
204
CUSTOMER DATABASE OR SECURITY SERVER
202
WRITE
VALID ?
YES
205
LOG USER ACTIVITY
206
DHCP REQUEST ?
NO
208
NO
220
PROVIDE NEW TEMPORARY CONFIGURATION INFORMATION TO USER
228
CUSTOMER'S CONFIGURATION INFORMATION
READ
210
YES
LOOKUP CUSTOMER'S CONFIGURATION INFORMATION
222
DIRECT USER TO SUBSCRIPTION LOGIN PAGE
WRITE
212
ASSIGN USER'S CONFIGURATION INFORMATION
218
PERFORM ANY NEEDED TRANSLATION OR REDIRECTION
NEW USER ?
YES
CREATE NEW USER ACCOUNT
224
226
NO
CHECK FOR VALID LOGIN
230
214
NORMAL PACKET PROCESSING & TRACKING
232
VALID LOGIN ?
NO
YES
216
DONE
234
STORE VALIDATED MAC ADDRESS

Fig. 6

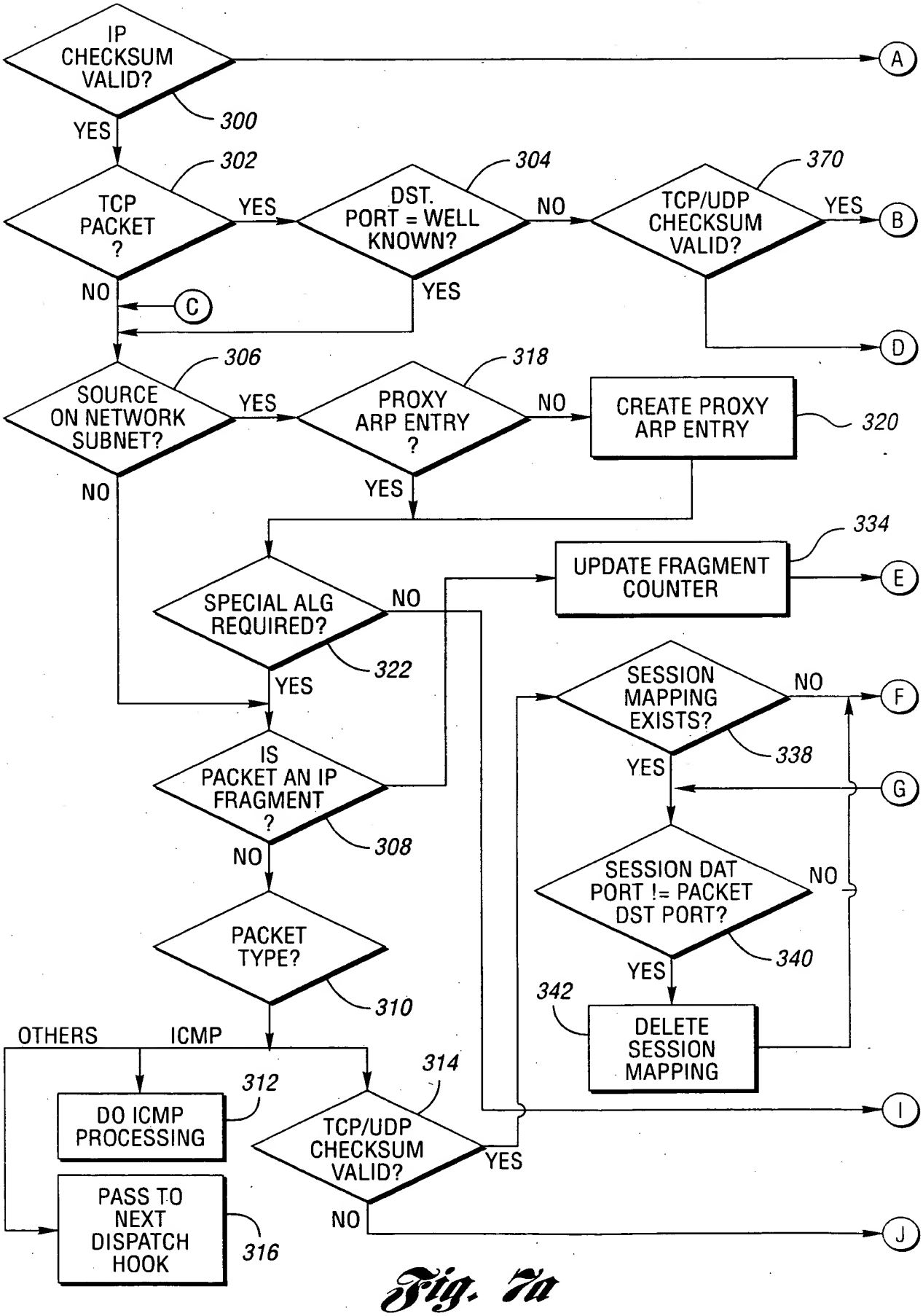

IP CHECKSUM VALID?
300
A
YES
TCP PACKET ?
302
YES
DST. PORT = WELL KNOWN?
304
NO
TCP/UDP CHECKSUM VALID?
370
YES
B
NO
C
YES
D
SOURCE ON NETWORK SUBNET?
306
YES
PROXY ARP ENTRY ?
318
NO
CREATE PROXY ARP ENTRY
320
NO
YES
UPDATE FRAGMENT COUNTER
334
E
SPECIAL ALG REQUIRED?
NO
322
YES
IS PACKET AN IP FRAGMENT ?
308
NO
PACKET TYPE?
310
OTHERS
ICMP
DO ICMP PROCESSING
312
PASS TO NEXT DISPATCH HOOK
316
TCP/UDP CHECKSUM VALID?
314
YES
NO
I
J
SESSION MAPPING EXISTS?
NO
338
F
YES
G
SESSION DAT PORT != PACKET DST PORT?
NO
340
YES
342
DELETE SESSION MAPPING

Fig. 7a

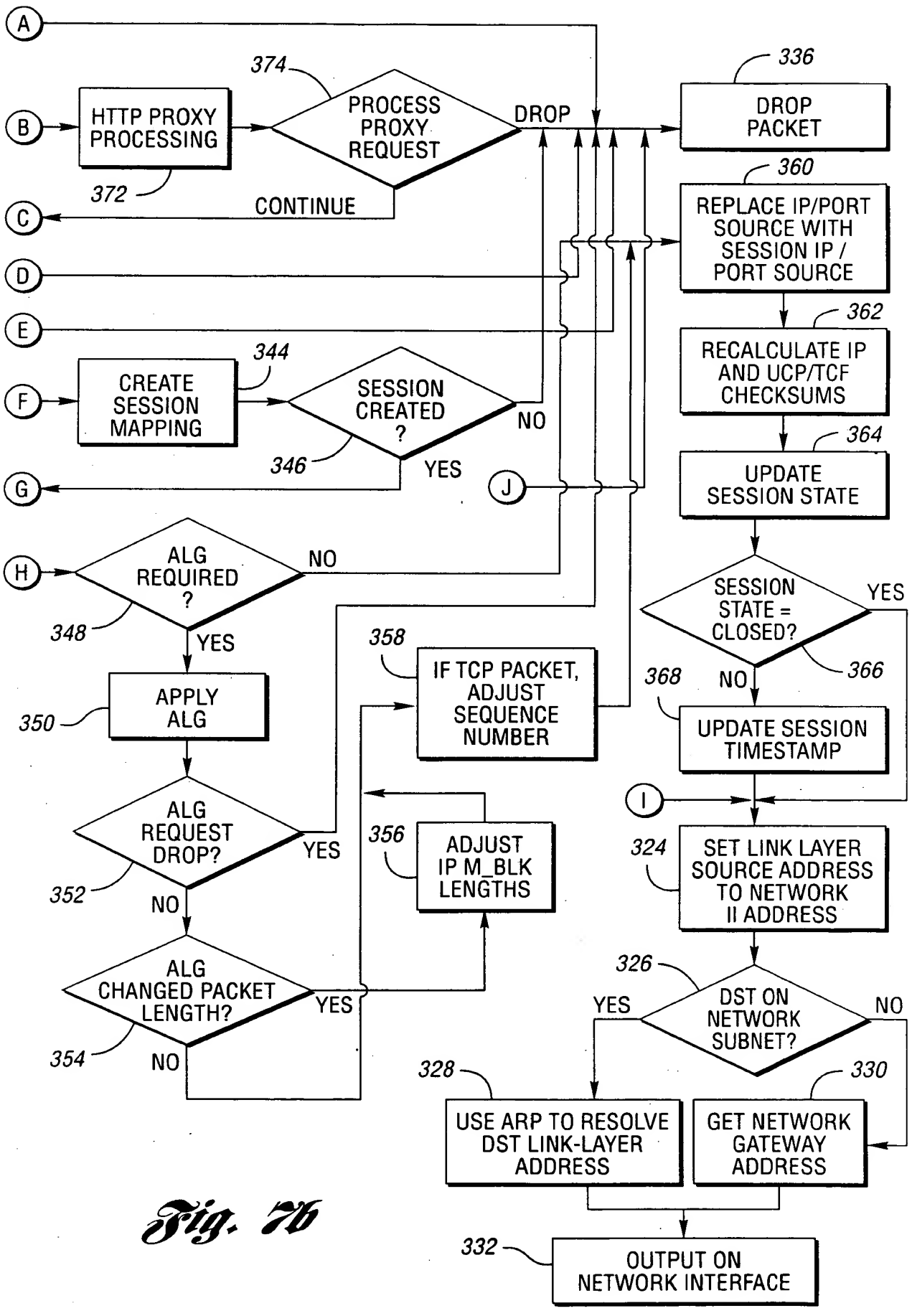

A
B
HTTP PROXY PROCESSING
372
374
PROCESS PROXY REQUEST
DROP
CONTINUE
C
D
E
F
CREATE SESSION MAPPING
344
SESSION CREATED ?
NO
346
YES
G
H
ALG REQUIRED ?
NO
348
YES
APPLY ALG
350
ALG REQUEST DROP?
YES
352
NO
ALG CHANGED PACKET LENGTH?
YES
354
NO
358
IF TCP PACKET, ADJUST SEQUENCE NUMBER
356
ADJUST IP M_BLK LENGTHS
J
336
DROP PACKET
360
REPLACE IP/PORT SOURCE WITH SESSION IP / PORT SOURCE
362
RECALCULATE IP AND UCP/TCF CHECKSUMS
364
UPDATE SESSION STATE
SESSION STATE = CLOSED?
YES
366
NO
368
UPDATE SESSION TIMESTAMP
I
324
SET LINK LAYER SOURCE ADDRESS TO NETWORK II ADDRESS
326
DST ON NETWORK SUBNET?
YES
NO
328
USE ARP TO RESOLVE DST LINK-LAYER ADDRESS
330
GET NETWORK GATEWAY ADDRESS
332
OUTPUT ON NETWORK INTERFACE

Fig. 7b

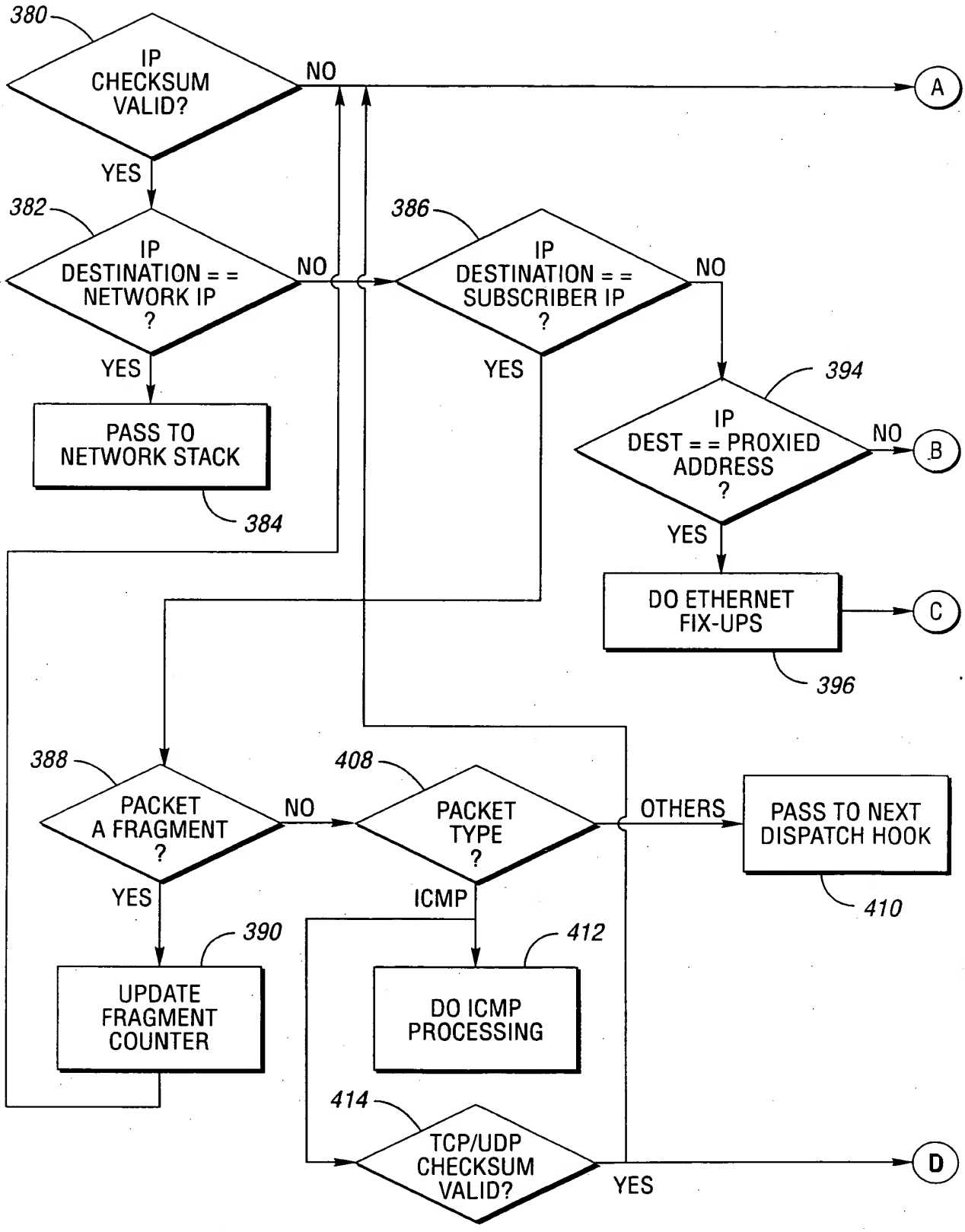

380
IP CHECKSUM VALID?
NO
A
YES
382
IP DESTINATION = = NETWORK IP ?
NO
386
IP DESTINATION = = SUBSCRIBER IP ?
NO
YES
YES
PASS TO NETWORK STACK
384
394
IP DEST = = PROXIED ADDRESS ?
NO
B
YES
DO ETHERNET FIX-UPS
C
396
388
PACKET A FRAGMENT ?
NO
408
PACKET TYPE ?
OTHERS
PASS TO NEXT DISPATCH HOOK
410
YES
ICMP
390
UPDATE FRAGMENT COUNTER
412
DO ICMP PROCESSING
414
TCP/UDP CHECKSUM VALID?
YES
D

Fig. 8a

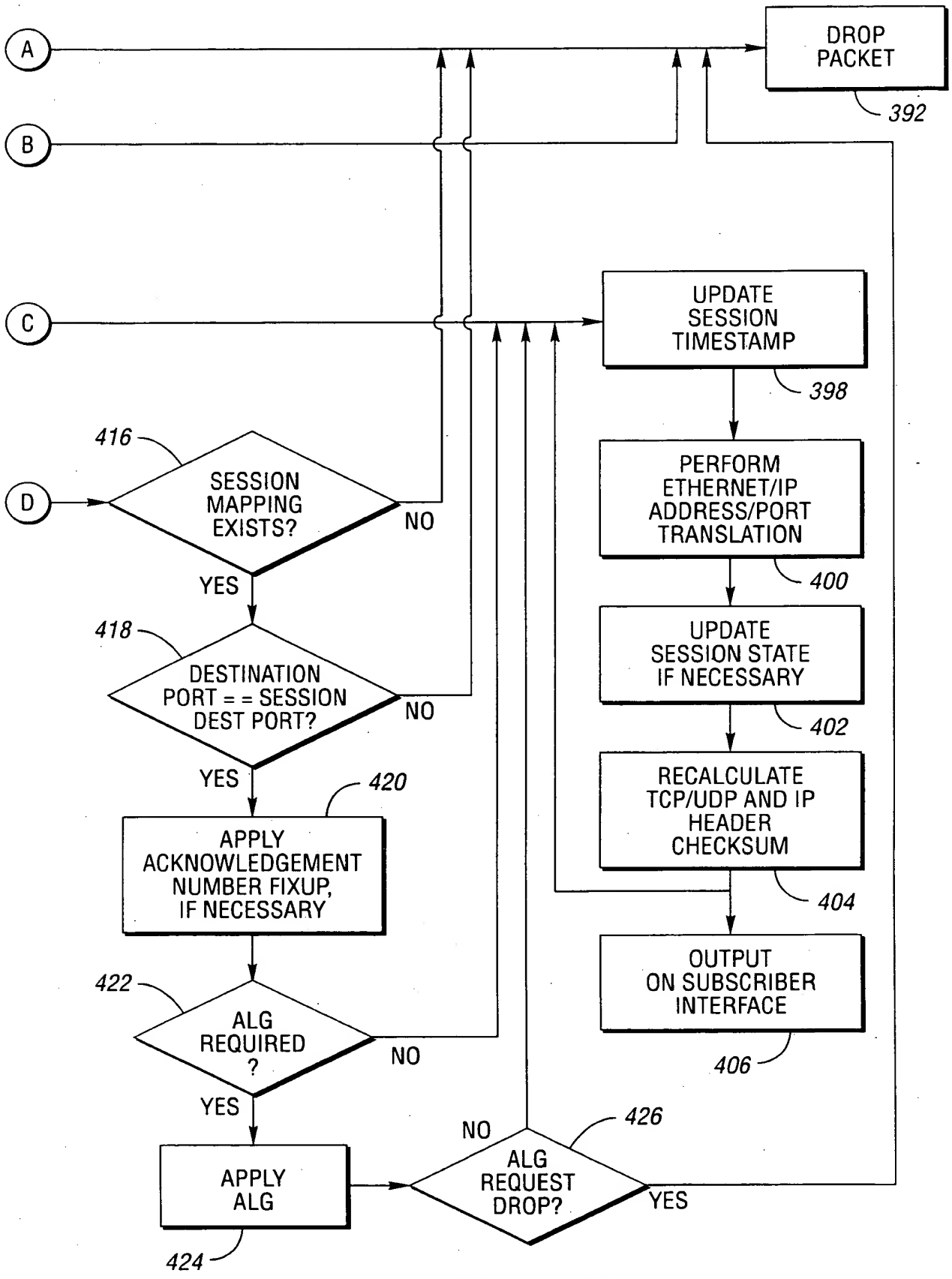

A
B
C
D
DROP PACKET
392
UPDATE SESSION TIMESTAMP
398
PERFORM ETHERNET/IP ADDRESS/PORT TRANSLATION
400
UPDATE SESSION STATE IF NECESSARY
402
RECALCULATE TCP/UDP AND IP HEADER CHECKSUM
404
OUTPUT ON SUBSCRIBER INTERFACE
406
416
SESSION MAPPING EXISTS?
NO
YES
418
DESTINATION PORT = = SESSION DEST PORT?
NO
YES
420
APPLY ACKNOWLEDGEMENT NUMBER FIXUP, IF NECESSARY
422
ALG REQUIRED ?
NO
YES
APPLY ALG
424
NO
426
ALG REQUEST DROP?
YES

Fig. 8b

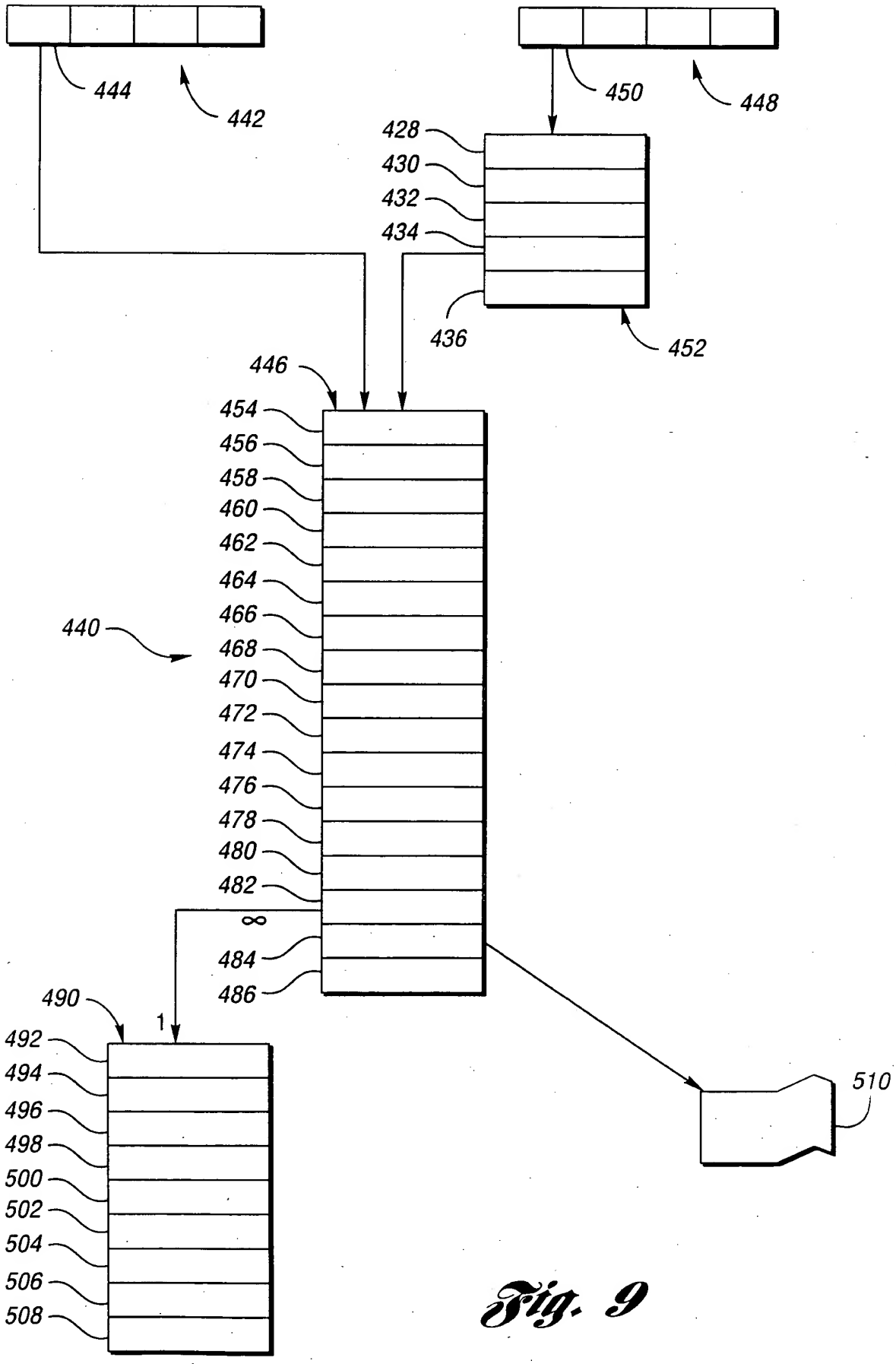

444
442
450
448
428
430
432
434
436
452
446
454
456
458
460
462
464
466
440
468
470
472
474
476
478
480
482
∞
484
486
490
1
492
494
496
498
500
502
504
506
508
510

Fig. 9

# SLOTS:	2048	4096	8192	16384	32768	65536	131072	PATRICIA
# SESSION	SLOT HASHED	SLOT HASHED	SLOT HASHED	SLOT HASHED	SLOT HASHED	SLOT HASHED	SLOT HASHED	TREE
256	1.125	1.0625	1.0313	1.016	1.0078	1.00391	1.002	8
512	1.25	1.125	1.0625	1.031	1.0156	1.00781	1.0039	9
1024	1.5	1.25	1.125	1.063	1.0313	1.01563	1.0078	10
2048	2	1.5	1.25	1.125	1.0625	1.03125	1.0156	11
4096	3	2	1.5	1.25	1.125	1.0625	1.0313	12
8192	5	3	2	1.5	1.25	1.125	1.0625	13
16384	9	5	3	2	1.5	1.25	1.125	14
32768	17	9	5	3	2	1.5	1.25	15
65536	33	17	9	5	3	2	1.5	16

Fig. 10

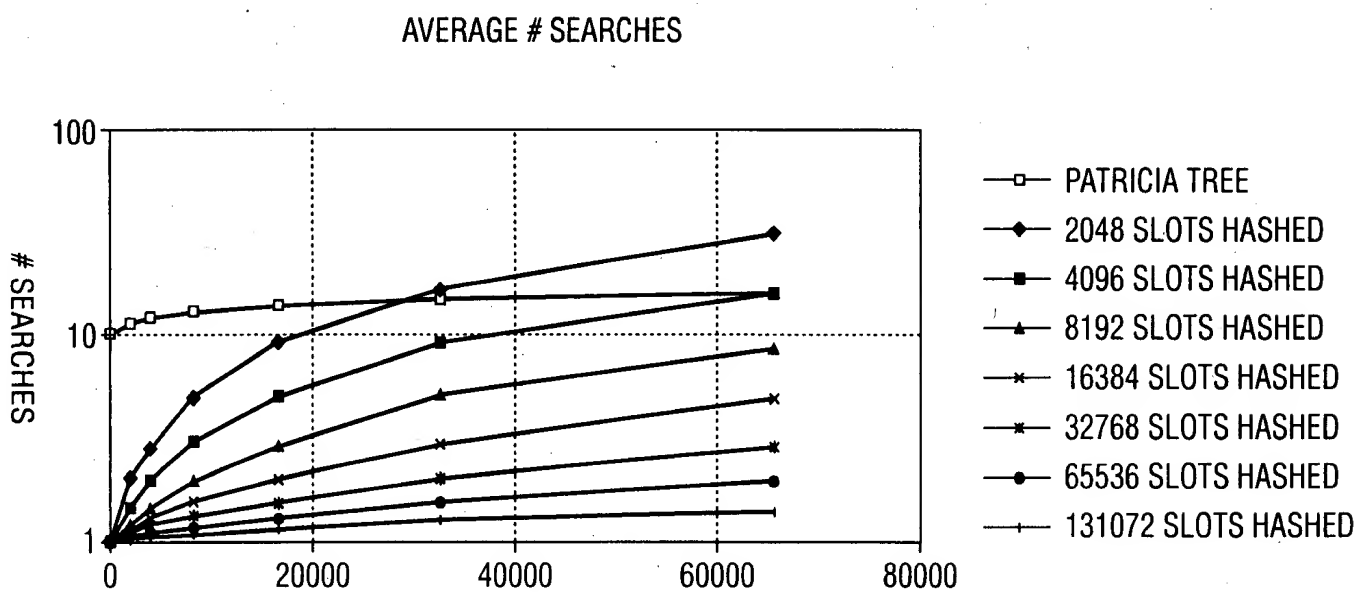


Fig. 11

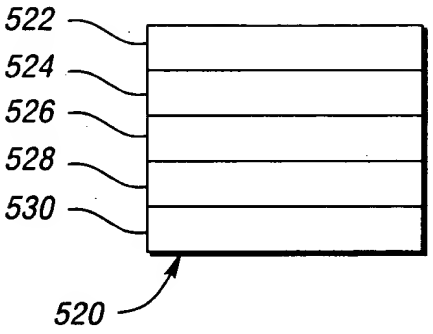

522
524
526
528
530
520

Fig. 12

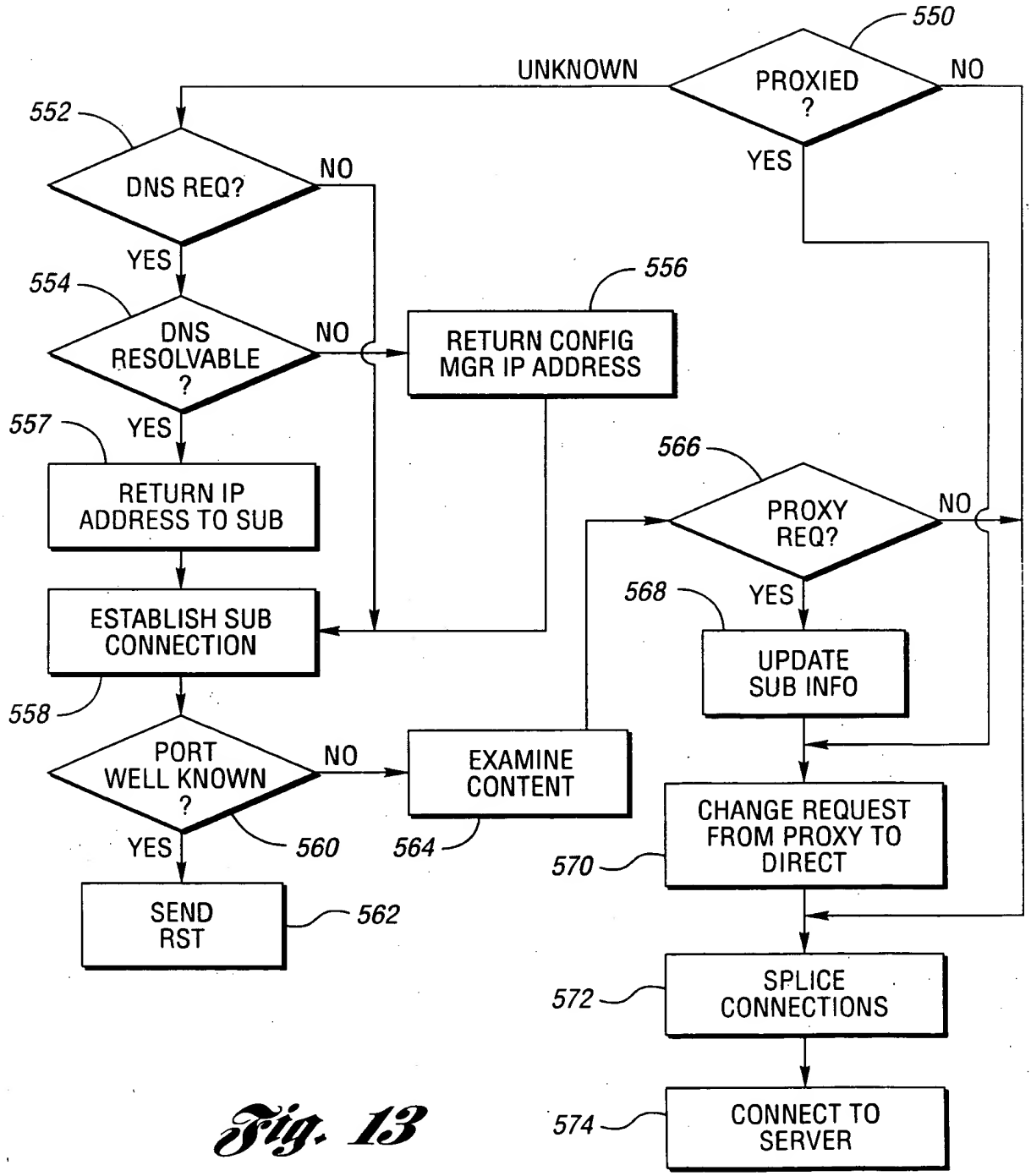

550
PROXIED ?
UNKNOWN
NO
YES
552
DNS REQ?
NO
YES
554
DNS RESOLVABLE ?
NO
556
RETURN CONFIG MGR IP ADDRESS
557
YES
RETURN IP ADDRESS TO SUB
ESTABLISH SUB CONNECTION
558
PORT WELL KNOWN ?
NO
560
YES
SEND RST
562
EXAMINE CONTENT
564
566
PROXY REQ?
NO
568
YES
UPDATE SUB INFO
CHANGE REQUEST FROM PROXY TO DIRECT
570
SPLICE CONNECTIONS
572
CONNECT TO SERVER
574

Fig. 13

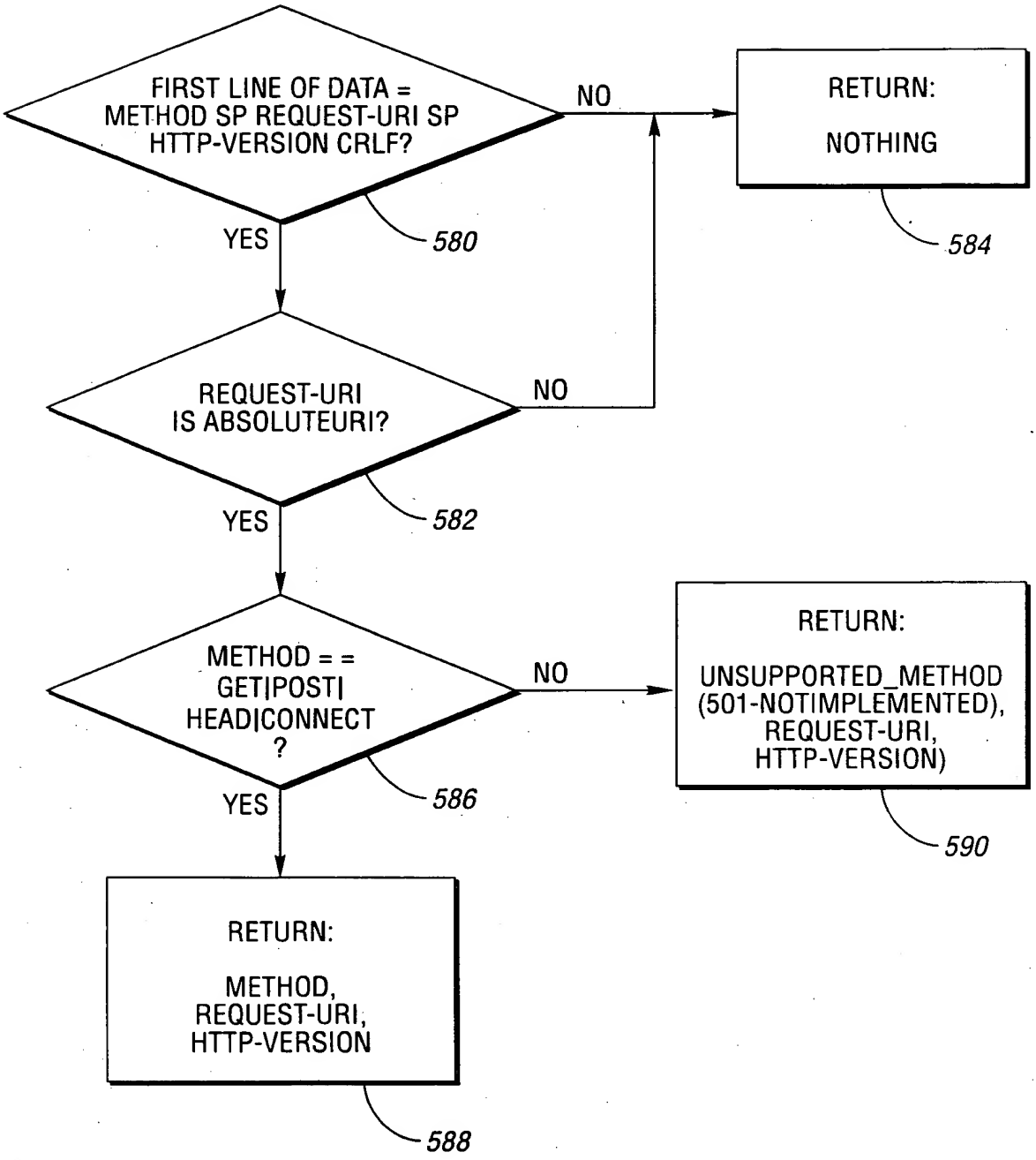

FIRST LINE OF DATA = METHOD SP REQUEST-URI SP HTTP-VERSION CRLF?
NO
RETURN:
NOTHING
580
584
YES
REQUEST-URI IS ABSOLUTEURI?
NO
582
YES
METHOD = = GET|POST| HEAD|CONNECT ?
NO
RETURN:
UNSUPPORTED_METHOD (501-NOTIMPLEMENTED), REQUEST-URI, HTTP-VERSION)
586
590
YES
RETURN:
METHOD, REQUEST-URI, HTTP-VERSION
588

Fig. 14

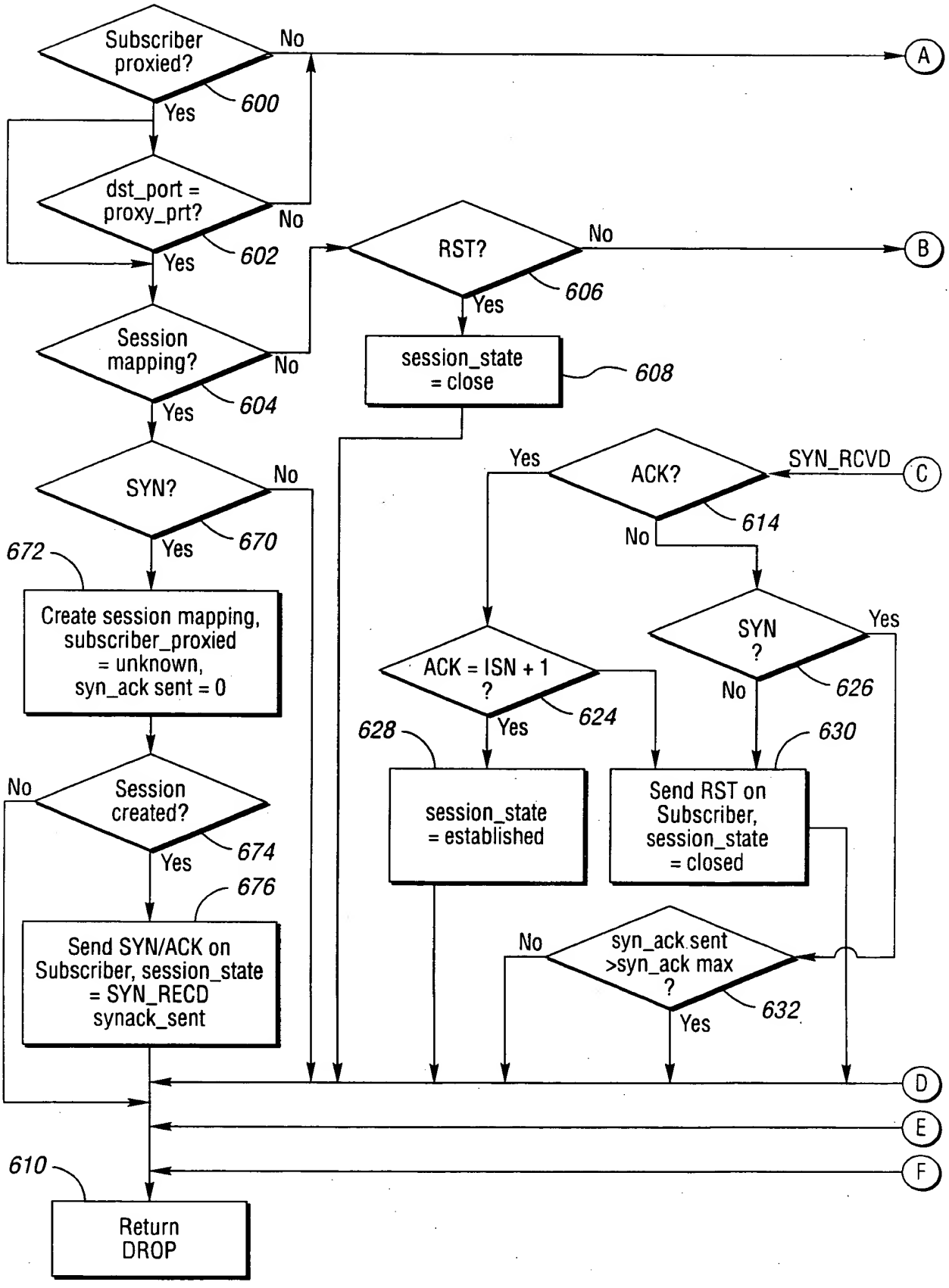

Subscriber proxied?
No
A
600
Yes
dst_port = proxy_prt?
No
602
Yes
RST?
No
B
606
Yes
Session mapping?
No
604
Yes
session_state = close
608
SYN?
No
670
Yes
Yes
ACK?
SYN_RCVD
C
614
No
672
Create session mapping, subscriber_proxied = unknown, syn_ack sent = 0
SYN ?
Yes
626
No
ACK = ISN + 1 ?
624
Yes
628
630
No
Session created?
674
Yes
session_state = established
Send RST on Subscriber, session_state = closed
676
Send SYN/ACK on Subscriber, session_state = SYN_RECD synack_sent
No
syn_ack sent >syn_ack max ?
632
Yes
D
E
F
610
Return DROP

Fig. 15a

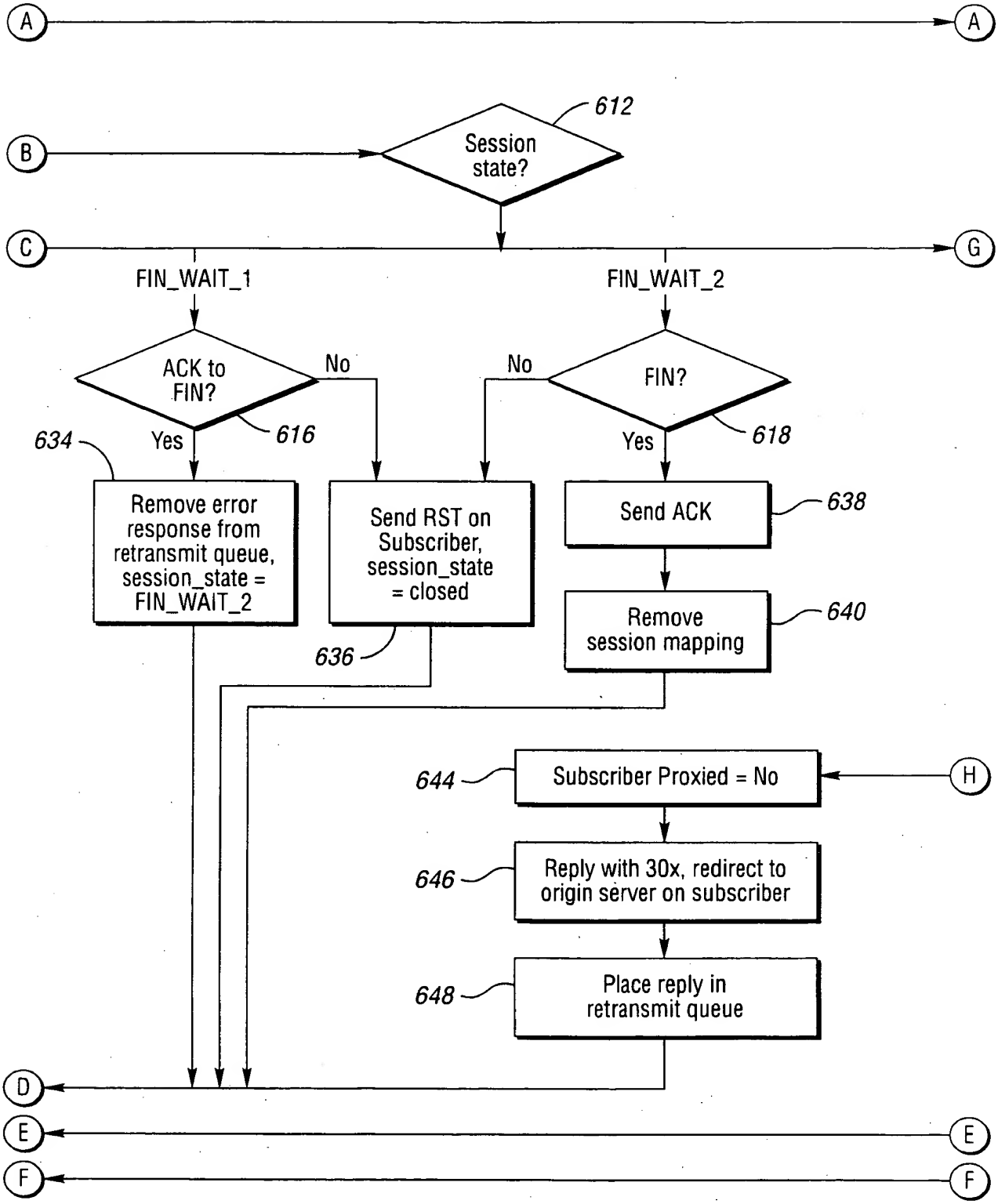

A
A
B
612
Session state?
C
G
FIN_WAIT_1
FIN_WAIT_2
ACK to FIN?
No
616
Yes
634
FIN?
No
618
Yes
Remove error response from retransmit queue, session_state = FIN_WAIT_2
Send RST on Subscriber, session_state = closed
636
Send ACK
638
Remove session mapping
640
644
Subscriber Proxied = No
H
646
Reply with 30x, redirect to origin server on subscriber
648
Place reply in retransmit queue
D
E
E
F
F

Fig. 15b

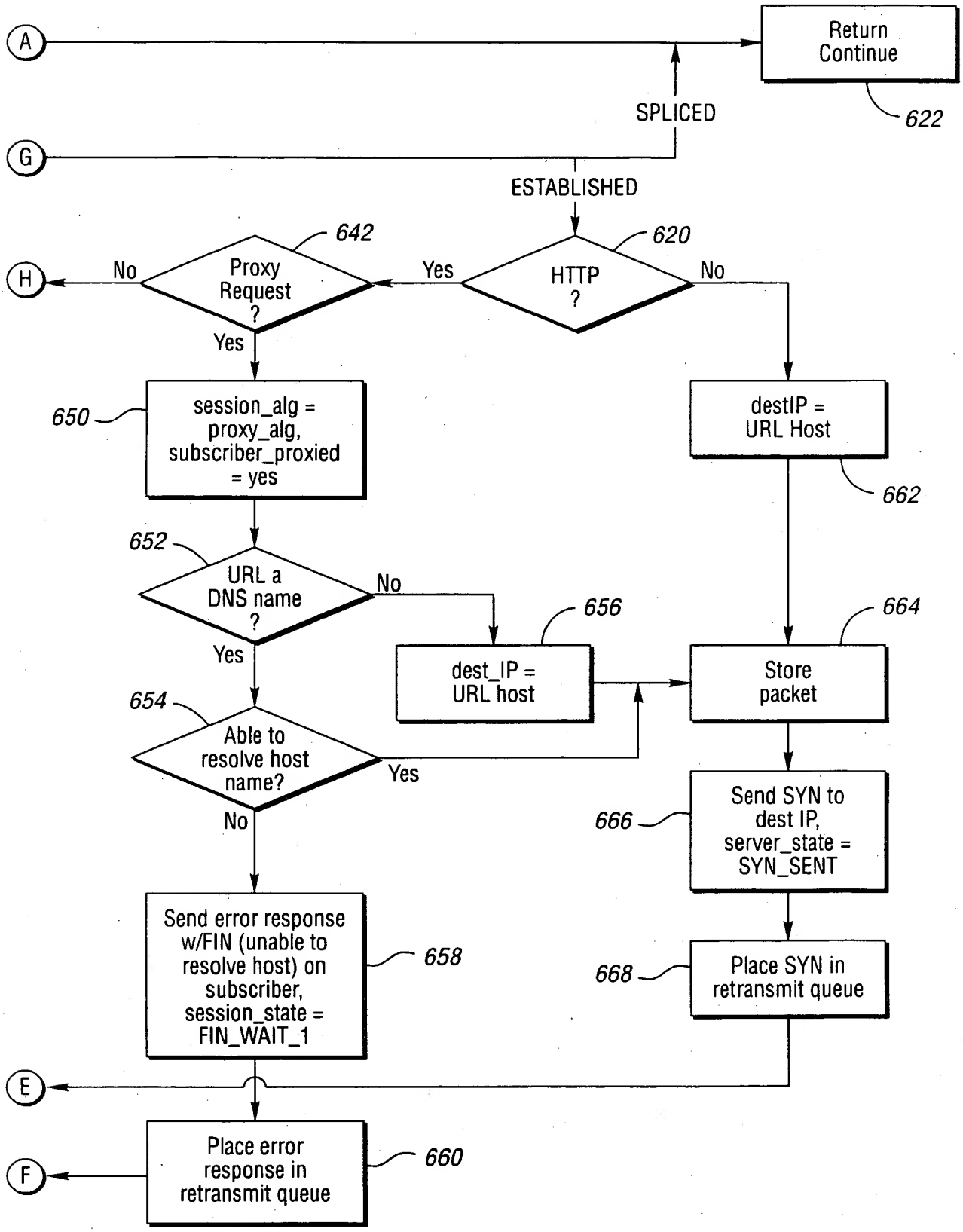

A
Return Continue
622
SPLICED
G
ESTABLISHED
642
620
H
No
Proxy Request ?
Yes
HTTP ?
No
Yes
650
session_alg = proxy_alg, subscriber_proxied = yes
destIP = URL Host
662
652
URL a DNS name ?
No
656
664
Yes
dest_IP = URL host
Store packet
654
Able to resolve host name?
Yes
No
666
Send SYN to dest IP, server_state = SYN_SENT
Send error response w/FIN (unable to resolve host) on subscriber, session_state = FIN_WAIT_1
658
668
Place SYN in retransmit queue
E
F
Place error response in retransmit queue
660

Fig. 15c

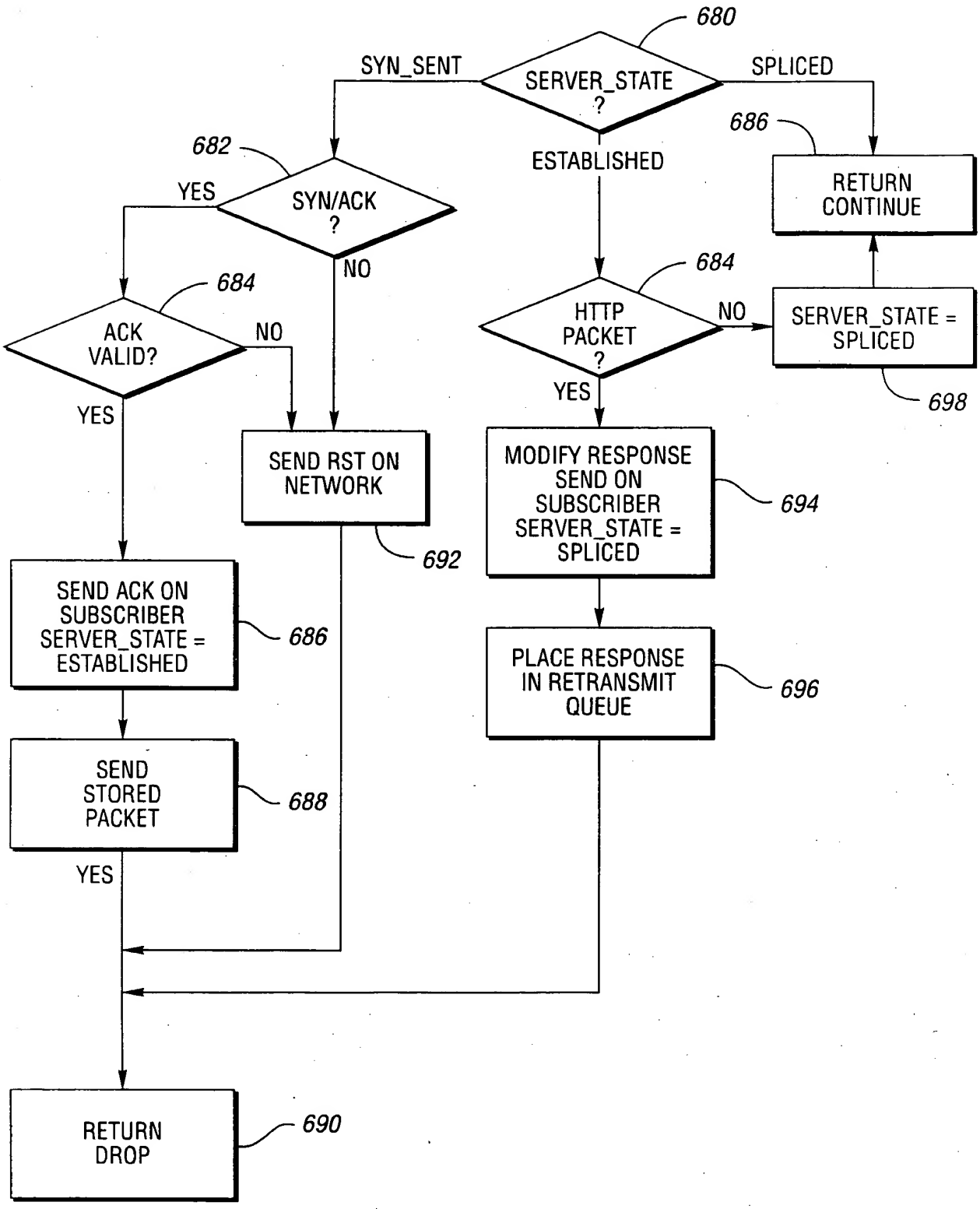

680
SERVER_STATE ?
SYN_SENT
SPLICED
ESTABLISHED
682
SYN/ACK ?
YES
NO
686
RETURN CONTINUE
684
ACK VALID?
NO
YES
684
HTTP PACKET ?
NO
YES
SERVER_STATE = SPLICED
698
SEND RST ON NETWORK
692
MODIFY RESPONSE SEND ON SUBSCRIBER SERVER_STATE = SPLICED
694
SEND ACK ON SUBSCRIBER SERVER_STATE = ESTABLISHED
686
PLACE RESPONSE IN RETRANSMIT QUEUE
696
SEND STORED PACKET
688
YES
RETURN DROP
690

Fig. 16

UNCLASSIFIED

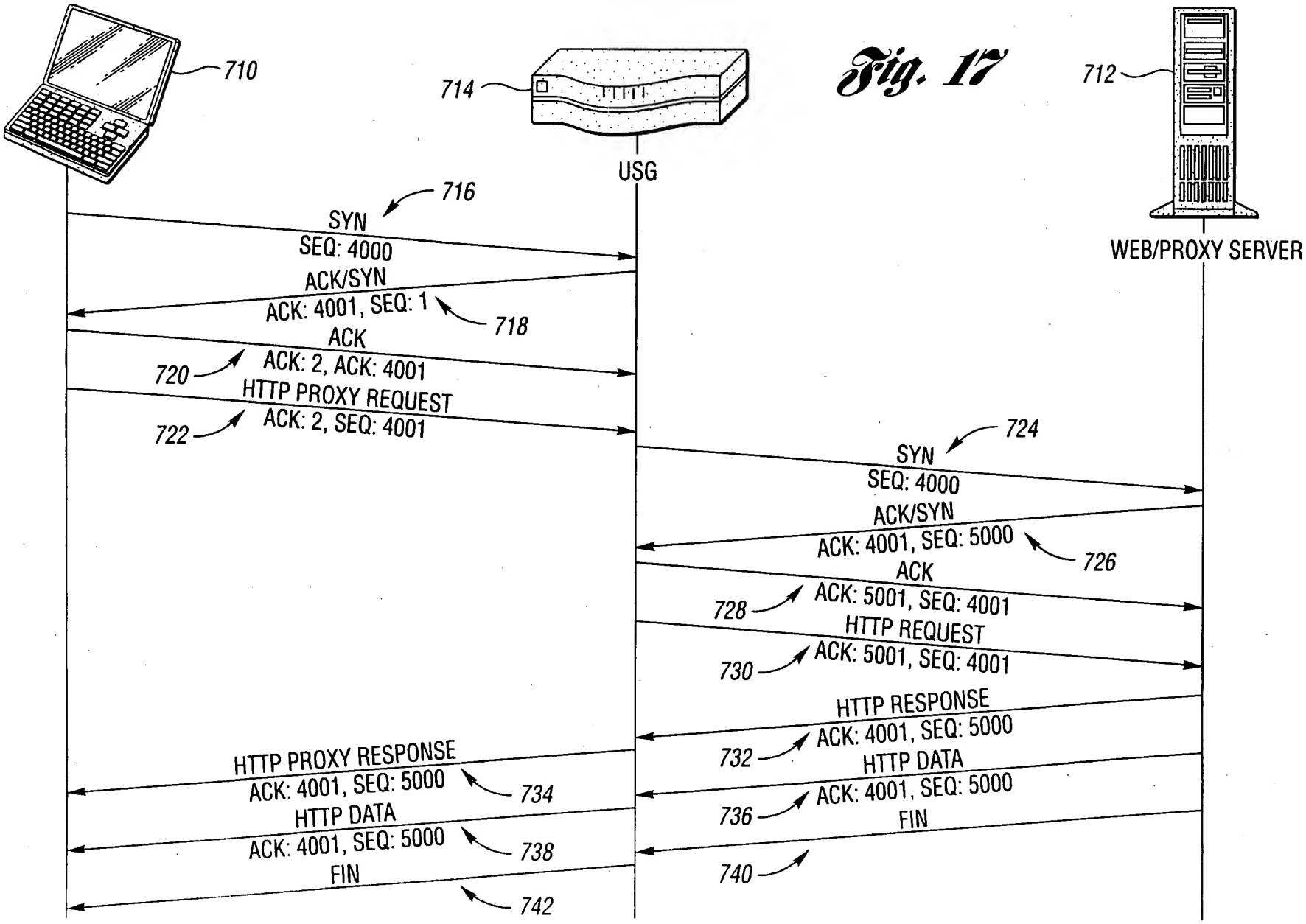


Fig. 17

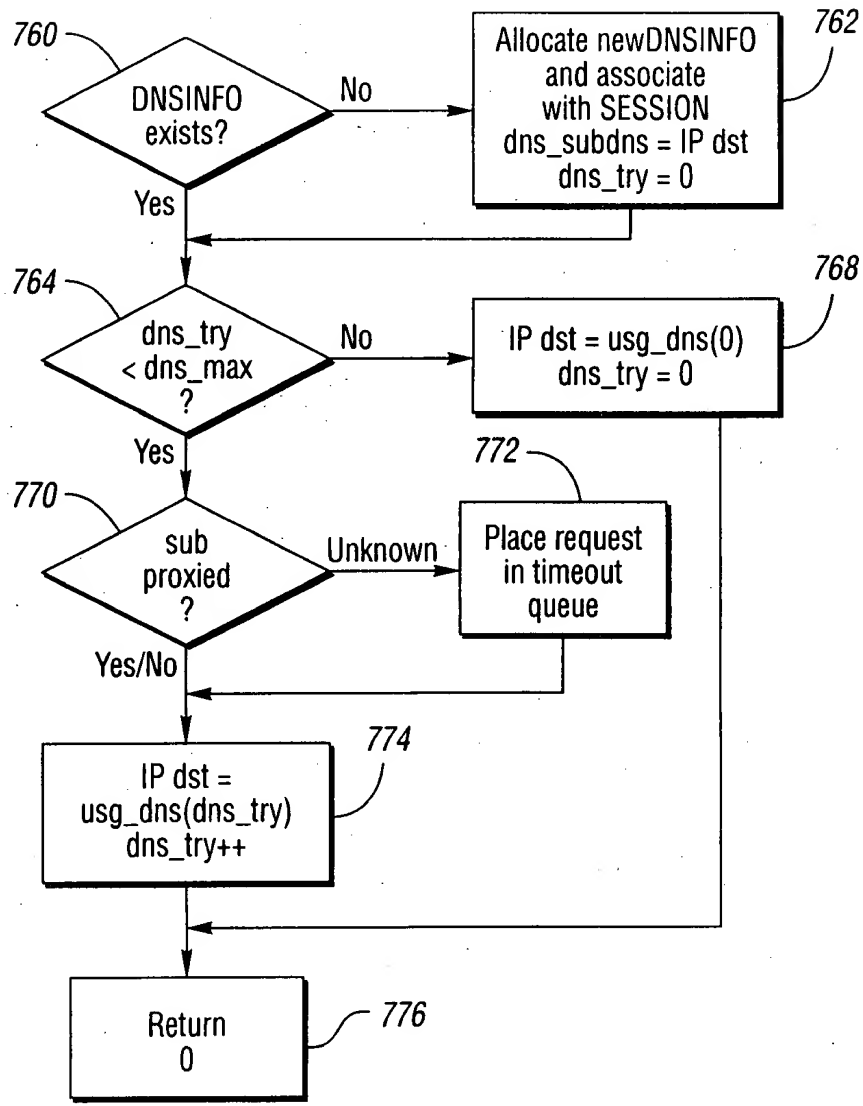

760
DNSINFO exists?
No
762
Allocate newDNSINFO and associate with SESSION dns_subdns = IP dst dns_try = 0
Yes
764
dns_try < dns_max ?
No
768
IP dst = usg_dns(0) dns_try = 0
Yes
770
sub proxied ?
Unknown
772
Place request in timeout queue
Yes/No
774
IP dst = usg_dns(dns_try) dns_try++
Return 0
776

Fig. 18

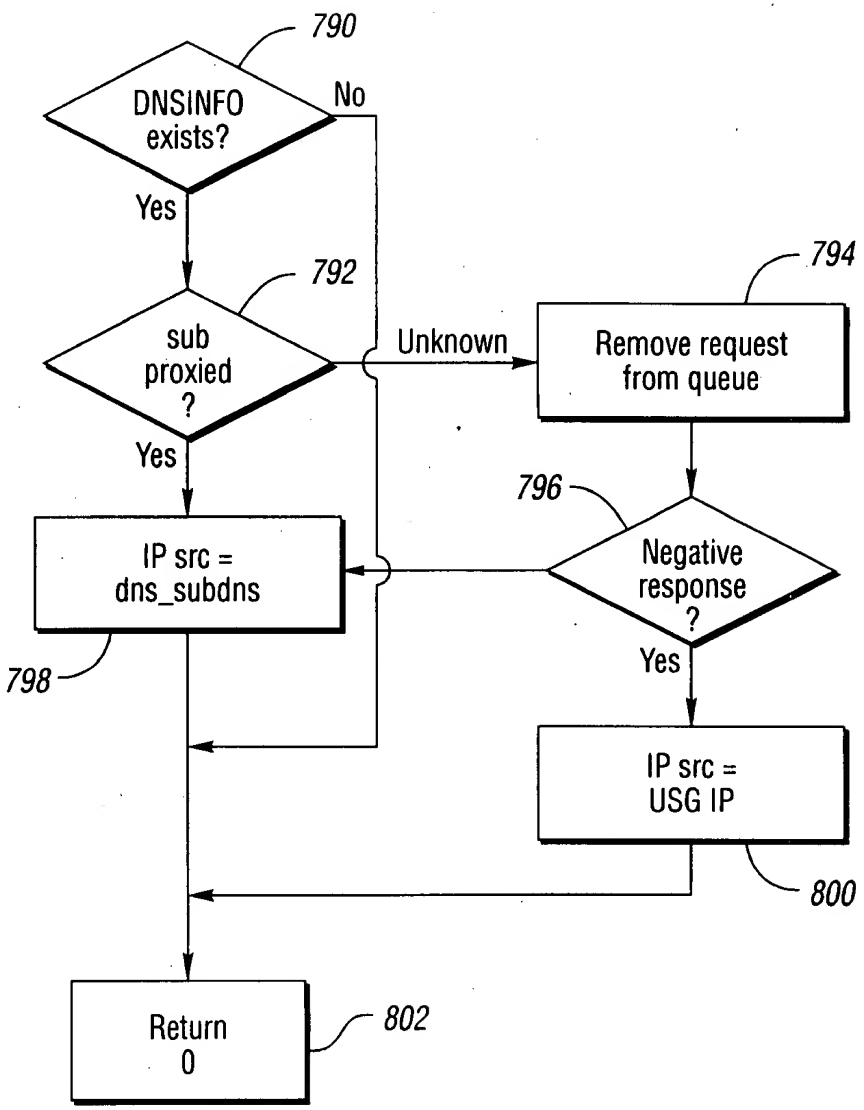
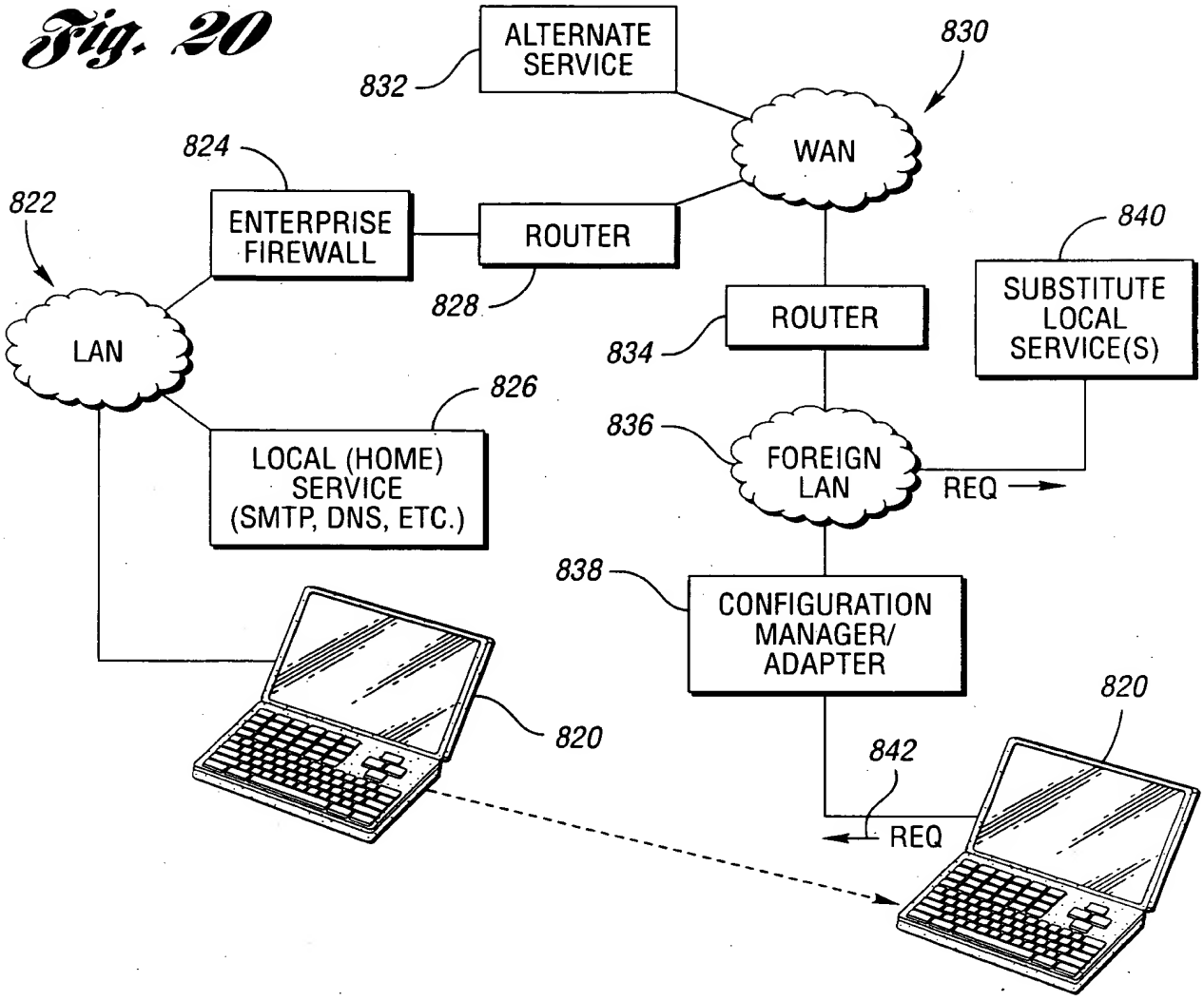

790
DNSINFO exists?
No
Yes
792
sub proxied ?
Unknown
794
Remove request from queue
Yes
796
Negative response ?
IP src = dns_subdns
798
Yes
IP src = USG IP
800
Return 0
802

Fig. 19

Fig. 20


ALTERNATE SERVICE
832
830
WAN
824
822
ENTERPRISE FIREWALL
ROUTER
828
840
SUBSTITUTE LOCAL SERVICE(S)
LAN
ROUTER
834
826
LOCAL (HOME) SERVICE (SMTP, DNS, ETC.)
836
FOREIGN LAN
REQ
838
CONFIGURATION MANAGER/ ADAPTER
820
820
842
REQ

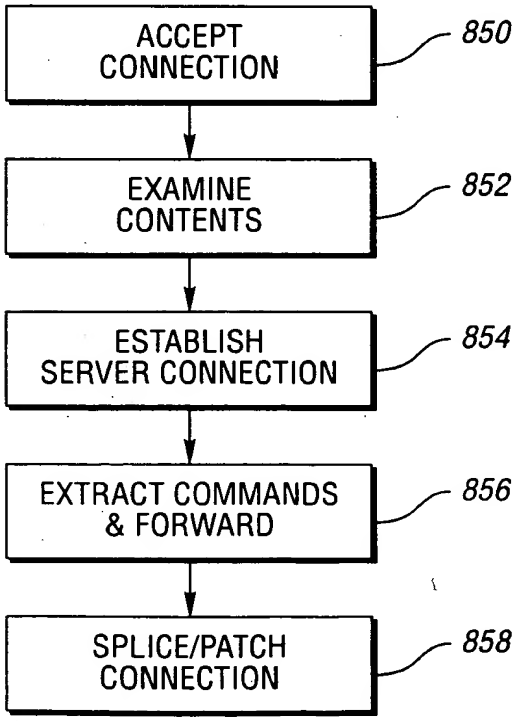

ACCEPT CONNECTION
850
EXAMINE CONTENTS
852
ESTABLISH SERVER CONNECTION
854
EXTRACT COMMANDS & FORWARD
856
SPLICE/PATCH CONNECTION
858

Fig. 21